

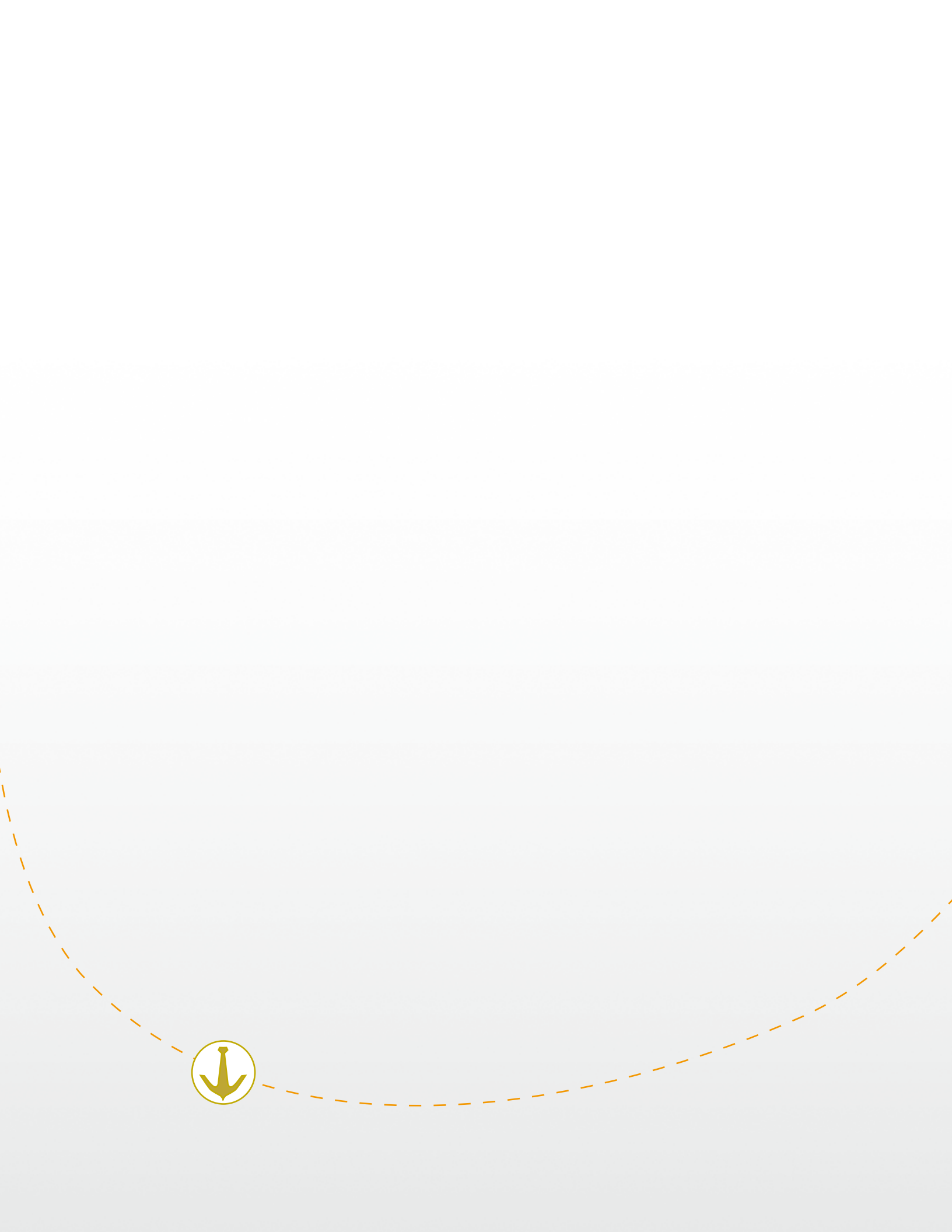
CHARTING Our Course

A Skills and Technology Roadmap for the
Canadian Printing and Graphic Communications Industry



People In Print







People in print

Charting Our Course

The Skills and Technology Roadmap for the Printing and
Graphic Communications Industry



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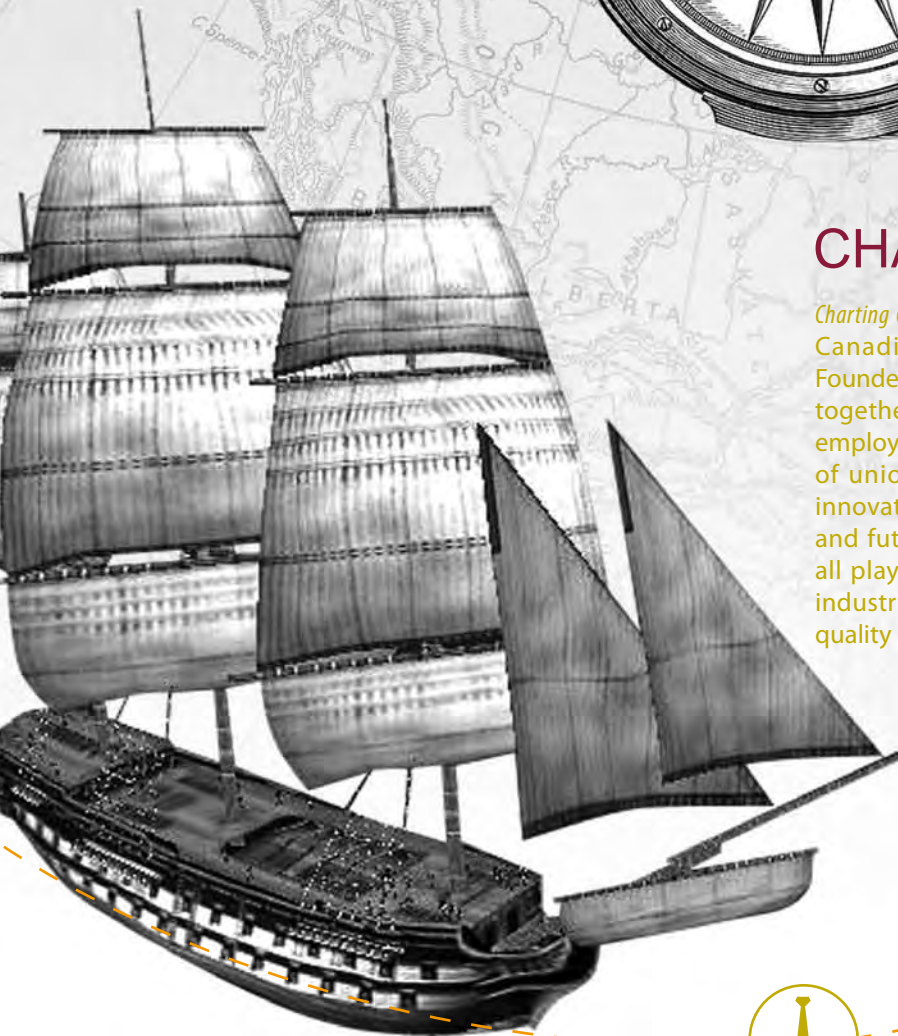
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CHARTING OUR COURSE

Charting Our Course is a vital planning tool prepared by the Canadian Printing Industries Sector Council (CPISC). Founded in April 2006, CPISC is a national forum that brings together printing and graphic communications industry employers and employees, educators and representatives of unions and governments to create and implement innovative approaches to skills development for current and future industry workers. In doing so, CPISC enables all players in the printing and graphic communications industry to work together in partnership to improve the quality of the industry's labour force.



EXECUTIVE SUMMARY

The Canadian Printing Industries Sector Council (CPISC) obtained funding from Human Resources and Social Development Canada and Industry Canada to spearhead development of a skills and technology roadmap for the printing and graphic communications industry. Unlike conventional technology roadmaps, which help industry stakeholders identify, understand and leverage the technologies that will drive the industry in the next 10 years, this skills and technology roadmap also explores the impact that adopting new technologies will have on human resources

issues such as skills development and training. In doing so, it provides industry players with a way to identify the skills-development requirements of the industry and contribute to developing strategies and methods that enable the industry to meet the workforce training needs associated with advances in technology.

To accomplish its objectives, the skills and technology roadmap addresses three fundamental questions: Where is our industry today? Where is our industry going? How do we get there?



Where is our industry today?

describes the current condition of the printing and graphic communications industry and highlights six factors that are exerting a profound influence on industry development.

Where is our industry going?

identifies significant technological changes in the industry, and links technological changes in the industry to skills development by identifying the training challenges associated with these changes.

How do we get there?

provides seven recommendations to help industry players develop and implement human resources strategies and tactics that will enable current and new industry workers to gain the skills they require to thrive and the industry to prosper.

Where is our industry today?

Although relatively stable and prosperous, the printing and graphic communications industry is not unchanging. Business practices are evolving. Competition is intensifying and becoming more global. And productivity is increasing and becoming evermore vital to the overall health of the industry and the companies that make it up.

To gain even greater insight into how the industry is changing, this roadmap carefully examines six factors that are driving change:

1. Burgeoning use of the Internet
2. Expanding markets
3. Shifting customer base



4. Progressively more specialized products and services
5. Advancing technology
6. Increasing need to ensure workers are equipped with new skills

The adoption of new technologies in particular is radically changing the industry's workforce. To be more precise, skills shortages are evident in two major areas: operating complex new print machinery, and understanding and leveraging the benefits spurred by the use of information technologies. A 2007 report prepared by the Canadian Printing Industries Sector Council highlighted some of the printing and graphic communications industry's most glaring challenges related to training:

- Although some 41 percent of new employees have no formal training, most companies find it difficult to release employees for training.
- Although industry suppliers offer a considerable amount of training, little of it is distance learning or technology-assisted learning.
- Training programs meet the needs of only one element of the printing process: pre-press. Little or no attention is given to the press and finishing/bindery aspects of the industry, which leads many businesspeople to think that program graduates are not prepared for jobs in the industry.
- Many educational institutions discontinued programs or parts of programs due to lack of interest, and few institutions offer part-time or continuing education programs.
- More than 90 percent of in-house training is employee-to-employee training.

But for these issues to be addressed, the industry must first define a set of national skill standards that reflects the impact of technology on skills development and the way in which the industry is now organized. To address this need, the Canadian Printing Industries Sector Council is pursuing two goals: first, developing basic, core and operational skill standards and occupational profiles for all three printing process areas (pre-press, press and finishing/bindery); and second, CPISC is adapting and updating skill standards to meet the needs of changing technologies.

Where is our industry going?

The skills and technology roadmap also pinpoints seven specific trends in technology that will have the greatest impact on the industry over the next ten years:

1. Enhanced systems integration
2. Greater demand for database management services
3. Widespread use of customer interface software
4. Significant developments in press technologies
5. Increased automation and integration of post-press tasks
6. Radical new advances in science and technology
7. Ever-increasing environmental awareness

In doing so, the roadmap identifies some of the training and skills-development challenges associated with the advanced technologies that will become increasingly apparent throughout the industry. For instance, printers will need to focus sharply on improving customer relations as web-to-print becomes entrenched in the printing and graphic communications industry. With web-to-print, printers will begin to interact with their clients in entirely new ways and will have greater opportunities to develop even stronger business relationships with customers. For printers to prosper, they will have to embrace this reality

and appreciate that their businesses are now more service providers than manufacturers. According to one prominent industry observer, however, this new truth is still a barely dawning realization for many industry vendors.

How do we get there?

The skills and technology roadmap gives industry players a series of sensible, straightforward recommendations to address these technological and related skills-development challenges. To be more precise, seven strategic and tactical moves have been developed and validated through several intensive meetings at which a wide cross-section of industry players modified draft recommendations and suggested new ones. Together, these seven recommendations will help industry players ensure current and new industry workers gain the skills they require to thrive and the industry to prosper.

1. Explore development of national training programs and delivery models based on industry-developed skills standards
2. Develop management and process training tools
3. Create an industry-awareness program
4. Improve systems integration capability
5. Develop a database management research program
6. Enhance industry access to support for training and technology
7. Support greater environmental awareness

Some companies, however, have embraced the challenges highlighted in this skills and technology roadmap, and used them as a springboard to achieve even greater performance and profitability. Known as 10 percenters, these businesses do not just eke out a meagre one-percent profit after expenses. They achieve profit margins of at least ten percent.

What makes these enterprises different from other businesses in the industry?

Three attributes of 10 percenters can be identified:

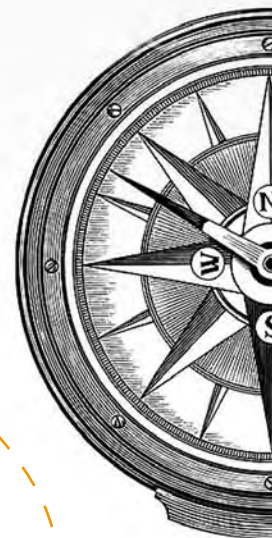
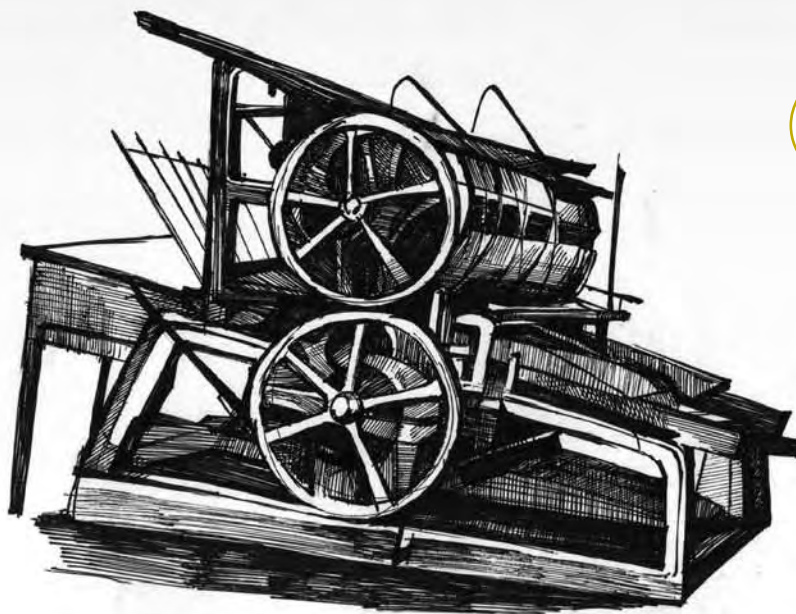
- They focus on improving internal processes and reducing costs.
- They focus on their people.
- They focus on strategically building their markets.



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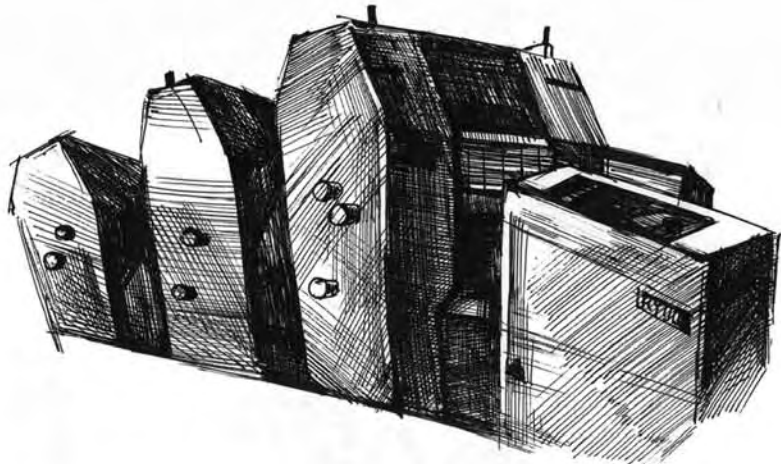
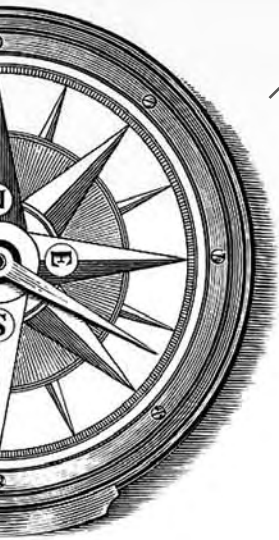
Six factors driving today's industry

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I. WHAT IS A SKILLS AND TECHNOLOGY ROADMAP AND WHY DOES OUR INDUSTRY NEED ONE?

Continual change is an inescapable feature of modern economic life. Trade barriers are coming down. New markets are opening up. Competition among firms is becoming increasingly fierce. Demand for expertly trained young workers is escalating everyday. And ever-more advanced methods of communication are sending information to all parts of the globe with progressively greater speed and ease.

Canada's printing and graphic communications industry has not been immune from this ever-accelerating onslaught of change. Rapid advances in technology have had a particularly sharp influence on the industry. Indeed, emerging technologies have quickly become standard components throughout the design, production and transmission processes of industry companies, causing these businesses to virtually reinvent the way they generate print products, service clients and attract new customers. What is more, technological advances will likely have an even greater impact on the industry as printing processes and functions become increasingly inter-related.

To keep pace with the rapid rate of technological change, some business owners and operators in the industry have restructured their operations, invested in new equipment, trained and retrained workers, downsized and/or replaced workers with new ones with different skill sets. Indeed, advances in technology have not only intensified the need for a highly skilled, adaptable workforce, but have also radically transformed the skills-development requirements of the industry.

Understanding how adopting new technologies affects skills development

To help business owners and operators in the printing and graphic communications industry gain a greater understanding of the impact of technology and how the adoption of technological advances will affect decisions related to skills development and training, the Canadian Printing Industries Sector Council (CPISC) obtained

funding from Human Resources and Social Development Canada and Industry Canada to spearhead development of a skills and technology roadmap for the industry.

What is a skills and technology roadmap? A skills and technology roadmap is a slightly modified version of a conventional technology roadmap. Traditionally, technology roadmaps are planning tools designed to:

- predict the technologies that will impact future markets,
- chart a path for commercializing the right technologies,
- guide decisions related to the research and development of technologies,
- build research and development-based partnerships and collaborations,
- help businesses seize new market opportunities, and
- provide policymakers with vital input on which to base decisions.

Led by a Project Steering Committee made up of key industry leaders, CPISC broadened the scope of the conventional technology roadmap model beyond helping industry stakeholders identify, understand and leverage the technologies that will drive the industry in the next 10 years. The roadmap of the printing and graphic communications industry also explores the impact that adopting new technologies will have on human resources issues such as skills development and training. In doing so, it provides industry players with a way to identify the skills-development requirements of the industry and contribute to developing strategies and methods that enable the industry to meet the workforce training needs associated with advances in technology.

Producing the roadmap

This skills and technology roadmap was completed in three distinct phases. In the first phase, the roadmap project team established the scope of the roadmap by determining that it should address three fundamental questions:

- Where is our industry today?
- Where is our industry going?
- How do we get there?

To answer the first of the three questions, the project team conducted a comprehensive state-of-the-field review to gain an accurate understanding of the current condition of the industry.



In the second phase, the project team set about responding to the second and third questions. To do so, the project steering committee identified key technology areas that are expected to dominate skills development in the industry over the coming decade.

Four working group meetings made up of key industry players were then held to delve deeply into how each key technology area would impact the printing industry during the coming decade. In the final working group session, participants identified how industry resources could be used to take advantage of significant technological changes, and generated recommendations that the industry could follow to address the impacts posed by advances in technology.

In the third and final phase, more than 50 industry players gathered at three regional meetings to validate the content and direction of the roadmap, and develop an implementation plan to ensure the industry can transform roadmap recommendations into results. In particular, the implementation plan is designed to leverage existing programs and establish new ones to ensure the printing industry maximizes its potential in an environment of rapid technological change.

A vital element of the implementation plan is measuring the results of these current and new programs. Using these results, adjustments will be made to the roadmap over time to ensure that it—as well as the recommendations and action items that flow from the roadmap—accurately reflect the evolving condition of the industry.

What lies ahead

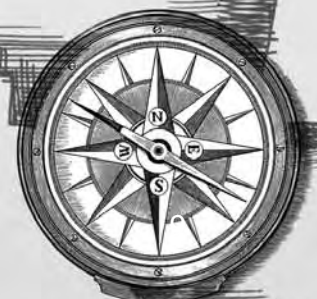
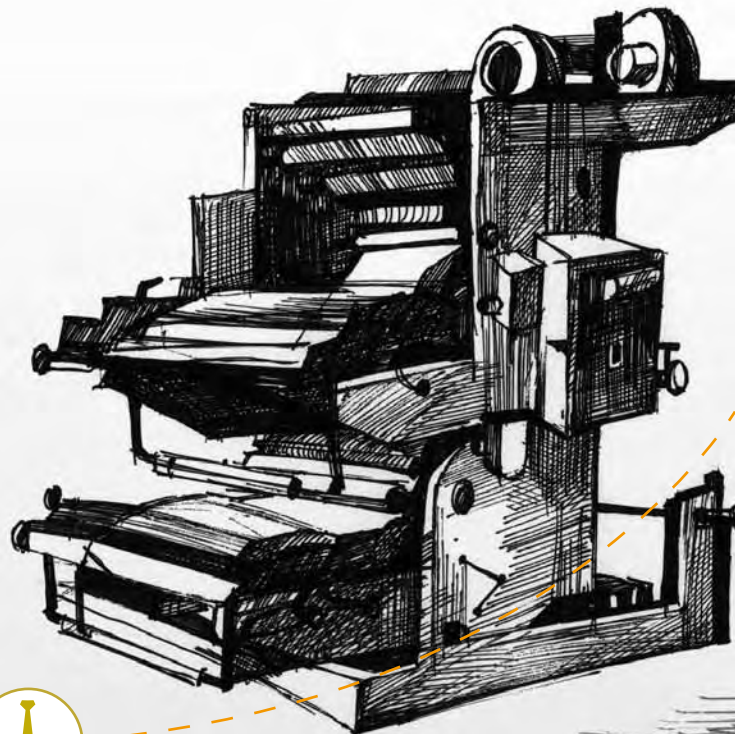
Structurally, the skills and technology roadmap adheres to the scope identified by project representatives in the first phase of project development, and in doing so, addresses the three fundamental questions established by project representatives: Where is our industry today? Where is our industry going? How do we get there?

Accordingly, the next section of the roadmap—Where is our industry today?—describes the current condition of the printing and graphic communications industry

and highlights six factors that are exerting a profound influence on industry development.

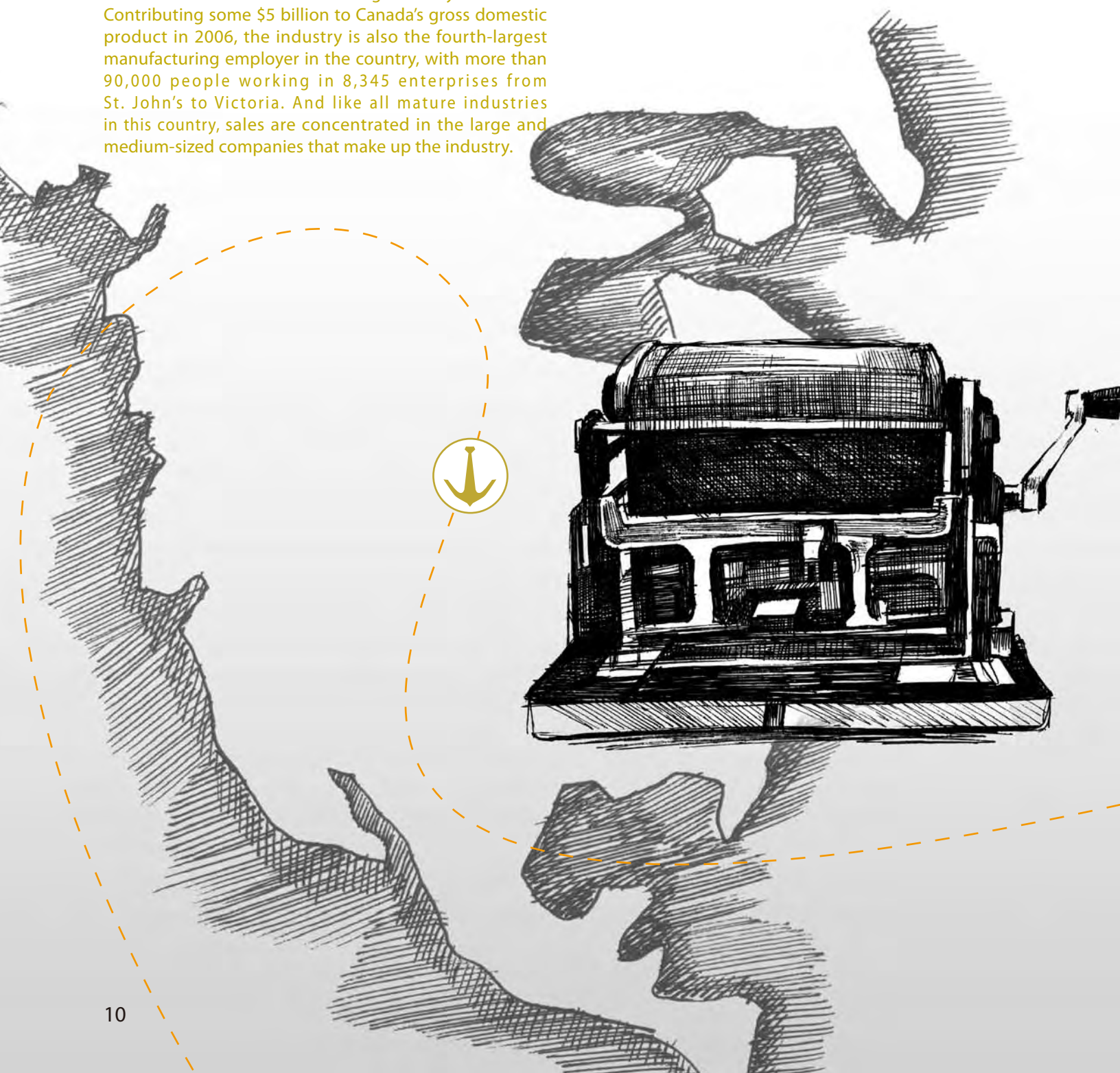
The third section—Where is our industry going?—identifies significant technological changes in the industry, and links technological changes in the industry to skills development by identifying the training challenges associated with these changes.

The fourth and final section—How do we get there?—provides seven recommendations to help industry players develop human resources strategies that will enable current and new industry workers to gain the skills they require to thrive and the industry to prosper.



II. WHERE IS OUR INDUSTRY TODAY?

The printing and graphics communications industry is the longest-established and most geographically widespread information-based manufacturing industry in Canada. Contributing some \$5 billion to Canada's gross domestic product in 2006, the industry is also the fourth-largest manufacturing employer in the country, with more than 90,000 people working in 8,345 enterprises from St. John's to Victoria. And like all mature industries in this country, sales are concentrated in the large and medium-sized companies that make up the industry.



Fewer workers

Despite the impressive number of enterprises in the industry, employment in the country's printing and graphic communications industry is declining. Indeed, this decline is expected to continue for the foreseeable future. Although no figures exist for Canada, the United States Department of Labor foresees employment in that country's printing industry dropping by 22 percent over the next decade.

Whatever the underlying reason behind this drop in industry employment, the trend is evident in most if not all manufacturing sectors in Canada. The Organisation for Economic Co-operation and Development states that output and employment in nearly all manufacturing industries in developed countries is dropping. While some manufacturing sectors are growing, their shares of the overall economy are shrinking and are expected to decrease further in the future.

An aging workforce

In the printing and graphic communications industry, nearly half of all employees are approaching retirement age, with 30 percent of all industry employees between the ages of 46 to 54 years and 19 percent older than 55 years of age. This trend, however, has yet to have an impact. Indeed, the industry experiences little annual turnover in staff and is successful at retaining workers.

But storm clouds are gathering. According to a recent study undertaken by The Conference Board of Canada, the manufacturing sector in general attracts a disproportionately small share of young workers—and this share is diminishing each year. Meanwhile, minorities, perhaps this country's greatest untapped pool of new workers, make up only a small portion of the printing and graphic communications industry's workforce. While the industry is successful at retaining workers, the older workers that are released from the printing and graphic communications industry are more difficult to train than their younger counterparts.

Small enterprises dominate

Structurally, the Canadian printing and graphic communications industry is made up of two kinds of companies: large, nationwide firms and small businesses with fewer than five employees. Indeed, the industry is dominated by these small businesses, with some 6,200 of the 8,345 enterprises in the industry having fewer than five paid employees.

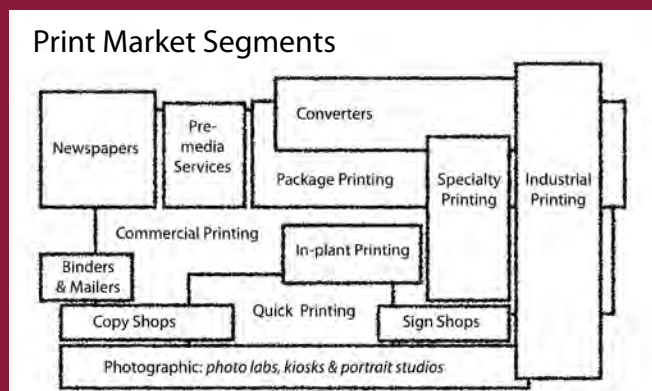
At the same time, the size of larger firms appears to be increasing. Consolidation of firms through mergers and acquisitions has reduced the overall number of companies. According to Statistics Canada, today there are 15 percent fewer Canadian companies in the printing and graphic communications industry than there were in 2004, and some 1,000 companies have closed each year since 2000. Industry analysts, however, state that consolidation is a normal part of the development of mature industries such as the printing and graphic communications industry.

While these figures are revealing, some industry players consider them incomplete. In particular, Statistics Canada does not define key groups, such as suppliers, as participants in the industry. In addition, the functions of some companies included in the industry are difficult to define. Both of these factors will have an impact on the industry's efforts to address the effects of technological change on skills development and training.

Increasing overlap among industry segments

As for types of printing companies within the industry, there is considerable variation—from small sign and copy shops to larger printers, such as newspapers and industrial printers. Industrial printers refers to those companies involved in producing a wide spectrum of printed components beyond traditional promotional and document printing.

Moreover, as can be seen in the graphic below, advances in technology are generating increasing overlap between industry segments. For instance, commercial printing touches on a several other types of printing. This trend means that all workers, regardless of where they lie within the industry, will be required to expand their knowledge and skills.



For the foreseeable future, however, digital printing will be the major growth area within the printing and graphic communications industry. What is more, this segment of the industry is forecast to grow at a rate nearly double the rate of growth in overall gross domestic product. As well, the market for flexo printing for packaging will be the major player in the printing and graphic communications industry for generations to come. On the other hand, revenues generated from offset printing will be flat until 2009, as this segment of the industry is expected to grow at a rate less than half that of overall gross domestic product.

Six Factors Driving Today's Industry

Although relatively stable and prosperous, the printing and graphic communications industry is not unchanging. Business practices are evolving. Competition is intensifying and becoming more global. And productivity is increasing and becoming evermore vital to the overall health of the industry and the companies that make it up.

To gain even greater insight into how the industry is changing, this roadmap examines six factors that are driving change in the printing and graphic communications industry:

1. Burgeoning use of the Internet
2. Expanding markets
3. Shifting customer base
4. Progressively more specialized products and services
5. Advancing technology
6. Increasing need to ensure workers are equipped with new skills

1. Burgeoning Use Of The Internet

The Internet has changed—and is changing—many if not all industries. The printing and graphic communications industry is no different. The Internet has reduced the overall volume of print by enabling many organizations themselves to distribute information in electronic form quickly and simply. Conversely, the Internet is being used to supplement and enhance print products:

- eBooks are being created in tandem with printed books.
- Websites optimize access to catalogues,

publications and brochures.

- Web advertising now works in conjunction with traditional advertising in magazines and journals.

The Internet also links customer prepress with printers to radically change how prepress is completed. And the Internet supports new business models, generates greater efficiency in customer interactions and spurs internal cost reductions for printers in the same way it does for businesses in other industry sectors.

What is more, opportunities driven by the Internet will only continue to grow as the increased use and sophistication of wireless devices expands the number of nodes at which users can access the Internet. At the same time, advances in photonics will continually increase the overall capacity, availability and affordability of the Internet.

Emergence of Web (Internet) printers

A growing number of companies in the industry embrace the Internet as a core tool. Known as Web or Internet printers, these companies conduct all of their customer interactions via the Web. And these transactions are seamless: Customers prepare their own work and then submit it to host sites for printing. This business model enables Web printers to service very small runs.

By offering new services in new ways, these companies are enjoying substantial growth. To be more precise, these companies enjoy revenue growth in excess of employee growth by a factor of three to one—if not more. As a result, Web printing companies—staffed by business school graduates and information technology specialists, as well as industry veterans—could be a model for many small and medium-sized businesses in Canada.

2. Expanding Markets

For many Canadian companies, globalization has been either a blessing or a curse—or both. This recent phenomenon of international business presents many Canadian businesses with tremendous opportunities for new markets and increasing trade. At the same time, globalization can bring homegrown enterprises directly into contact with fierce international competitors.

Unfortunately, Canada's printing and graphic communications industry has not adapted well to this new business



environment. To put it bluntly, printing in Canada has decreased because of globalization.

This trend can be measured in bottom-line terms. According to a study done by the Canadian Printing Industries Sector Council, the trade surplus of Canada's printing industry decreased from \$552 million in 2003 to \$40 million in 2007. Put another way, from 2003 to 2007, Canadian printing industry exports dropped from \$1.79 billion to \$1.43 billion. During the same period, imports of foreign printing services increased from \$1.24 billion to \$1.39 billion.

The reason behind this trend is straightforward. According to a prominent industry publication:

- When a product is manufactured overseas, the folded carton that holds the product, the manual that describes how the product works, the warranty card and the corrugated box in which it is shipped are all printed in that same country. Any promotional literature is also printed in that country too.

The way out of this dilemma is equally clear. According to a recent report by The Conference Board of Canada, to remain productive and competitive in this new international business environment, companies in Canada's manufacturing sector must continue to:

- invest in new technologies, equipment and machinery,
- develop new and improved processes and products, and
- invest in the skills and knowledge of its current and future workforce.

Accordingly, companies in the printing and graphic communications industry must increase investment in advanced machinery and equipment. They must also become increasingly involved in providing services that are part of the production process or that accompany finished products. As a result, industry workers must acquire increasingly more sophisticated skills. At the same time, industry players must recognize that the industry will be in increasing competition with employers in other manufacturing sectors for skilled workers.

3. Shifting Customer Base

During the past 25 years, sales to organizations in service

industries represent the greatest increase in commercial print sales. This trend—which is no surprise given the dramatic shift in advanced economies from manufacturing industries to service industries—is one of the key drivers reshaping the printing and graphic communications industry. As the industry's customers are based more and more in the service sector, the products and services provided by the industry will change as well.

For instance, four segments of the service industry constitute the overwhelming majority of customers for companies in the printing and graphic communications industry:

- technical and professional business support and related administrative services,
- wholesale and retail trade,
- civic, business and professional associations, and
- publishing.

In fact, 25 percent of the overall growth in commercial print sales during the past 25 years came from the first of these groups, while overall revenue from customers in these four segments increased by more than 400 percent between 1972 and 1982 and by 150 percent between 1982 and 1997.

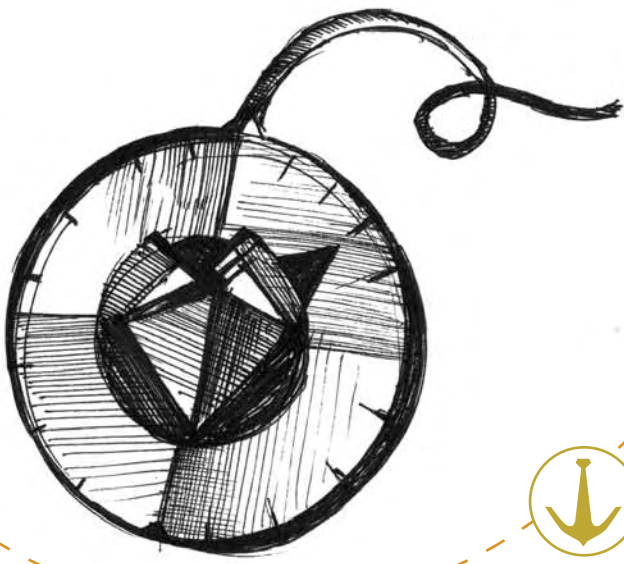
At the opposite end of the spectrum, three industry groups drastically reduced their use of commercial printing services that their 1997 purchases were less than the amount purchased in 1972. These groups are:

- paper, plastic and metal packaging,
- processed foods and related products, and
- finance, insurance and real estate.

The dramatic drop in revenues from these customer groups reflects the emergence and rapid growth of secondary print producers, or industries that perform their own printing. Although not classified as belonging to the printing industry, industries that perform their own printing were estimated in 1997 to be generating only 8.3 percent less print material than the actual printing industry.

4. Progressively More Specialized Products And Services

While the printing and graphic communications industry is traditionally characterized as a manufacturing industry,



the distinction between businesses that manufacture goods and those that provide services is becoming increasingly blurred. Most manufacturers today also provide services. Indeed, manufacturers are progressively relying on service delivery to retain existing customers and attract new ones.

The printing and graphic communications industry is no different. Services are becoming more and more important sources of revenue for printing companies. What is more, industry consolidation has separated firms into two main groups: large multinational companies that dominate the commodity portion of the market, can follow their customer and can win any price war with smaller competitors; and smaller firms that embrace a combination of new technology and business processes to offer goods and services that large corporations cannot. According to industry analysts, this trend is a normal development in mature industries such as the printing and graphic communications industry.

As a result of this evolution, small businesses within the industry must offer new value-added services to customers—not just to thrive, but simply to survive. As such, while some customers now undertake prepress tasks, many small businesses in the industry now specialize in providing new services, or in offering traditional services in ways that large multinational companies cannot. These services cover a range of printing-related areas, including:

- art, design and creative,
- CD/DVD production,
- client training and consulting,
- database and asset management and archiving,
- digital studio photography,
- facilities management,
- Internet and Web,
- kit fulfilment,
- logistics management, and
- mailing management.

To be even more precise, small and medium-sized

businesses in the industry are ‘wrapping’ products with related services. According to a study done by the Print Industries Market Information and Research Organization, non-print services generated some eight percent of industry revenues in 2005, with 13 percent forecast for 2010. A National Association of Printing Leadership survey indicated that the industry had already surpassed this forecast level, by reaching 14.5 percent in 2007.

While this development presents exciting new opportunities for small businesses, challenges also emerge. For instance, the new services-dominated economy moves faster and is more demanding than the traditional manufacturing-based economy. And customers now expect much more from printing companies than they can get through desktop publishing on their own personal computers.

As print evolves in the face of technological change, however, industry players are finding new ways to add value to their products and services:

- **Speed:** Today, 10 percent of all print is produced within a day. In 20 years, almost one-third of all print could be produced within a day.
- **Flexibility:** The trend for digital print run lengths continues downward and now averages in the 2,000-copy range.
- **Web-to-print:** Not just a way for customers to engage with printers, it is a whole new way of doing business.
- **Specialized printing:** Thirty-two percent of all jobs are more complex than flat sheets. Customers also want specialized coatings and imprinting.
- **Full colour:** An option that is growing from 48 percent of all pages today to 75 percent by 2020.
- **Variable data printing:** Personalized direct mail and other customized products are now within the reach of all graphic arts firms.
- **Distributed production:** To deal with postal issues, print production occurs closer to the point of distribution.
- **eCommerce:** Almost half of all printing is purchased by large companies, who will increasingly want to automate the print-buying process.

5. Advancing Technology

In mature industries such as the printing and graphic



communications industry, improvements in core technologies such as presses and inks occur incrementally. Statistics Canada data would suggest that this seemingly slow growth in the technological sophistication of the printing and graphic communications industry is due to a lack of genuine research and development on the part of the industry. To be more precise, the industry accounted for only \$7 million of the \$6.6 billion that Canada's manufacturing sectors spent on research and development in 2000.

This figure, however, is misleading. Industry players maintain that small companies solve many practical problems for which Scientific Research and Experimental Development (SR&ED) program credits are not claimed. At the same time, equipment suppliers to the printing industry, which are classified in economic accounts as a separate industry, devote a considerable amount of resources toward research and development. This expenditure by suppliers, which are mainly located outside Canada, is reflected in the \$343 million that was spent by printers to purchase equipment in 2000.

For the printing and graphic communications industry, this outsourcing of innovation to equipment suppliers is indicative of its status as a mature industry. As opposed to younger industries that develop their own technologies, the printing and graphic communications industry spurs innovation by working closely with its traditional partners such as press manufacturers, and with new partners such as Web services providers.

As a result of close collaboration with partners in the high-technology sector, advances in high technology are having a tremendous impact throughout the printing and graphic communications industry. Adoption of new technologies is enabling smaller companies to focus on specialty products and services. For larger companies, new technologies are helping them achieve continuous cycles of productivity improvement and cost reduction. Technological advances are even enabling some customers—of large and small printing companies—to fulfil their own printing needs.

6. Increasing Need To Ensure Workers Are Equipped With New Skills

Given the rapid pace of change within the industry, it is clear that companies have embraced new technologies.

But growth through technology means far more than purchasing the latest piece of equipment. It involves enhancing the overall process by which companies add value to the products and services they provide customers.

At the same time, the adoption of new technologies is radically changing the industry's workforce. The blunt truth is that fewer workers are needed because many printing processes can now be handled via new technologies.

But while fewer workers may be required, these workers must be highly skilled and possess broad knowledge of printing processes and specific skills in particular areas. These new workers must also have access to the training needed to manage new products and services, and deal with the implementation of new systems and processes brought about by advances in technology. In effect, the ability to attract skilled new workers, train existing workers to manage new technologies, and perform that training in a cost-effective manner has become a major challenge.

This dilemma is not unique to the printing and graphic communications industry. According to a recent report from The Conference Board of Canada, skills shortages appear to be closely linked to the use of technology—regardless of the industry. At the same time, as value-added and labour-intensive production migrates to countries with lower labour costs and manufacturing in Canada increasingly focuses on manufacturing-related services, the occupational mix of workers in the manufacturing sector will undergo considerable change.

For instance, the demand for general labourers and machine operators is expected to decline while demand for technicians is expected to grow. Technological changes will also alter the core skills requirements of the manufacturing sector. As such, employees will be required to have high-level basic skills—such as literacy, numerical proficiency, problem solving and working in teams—to work in increasingly technology-rich environments.

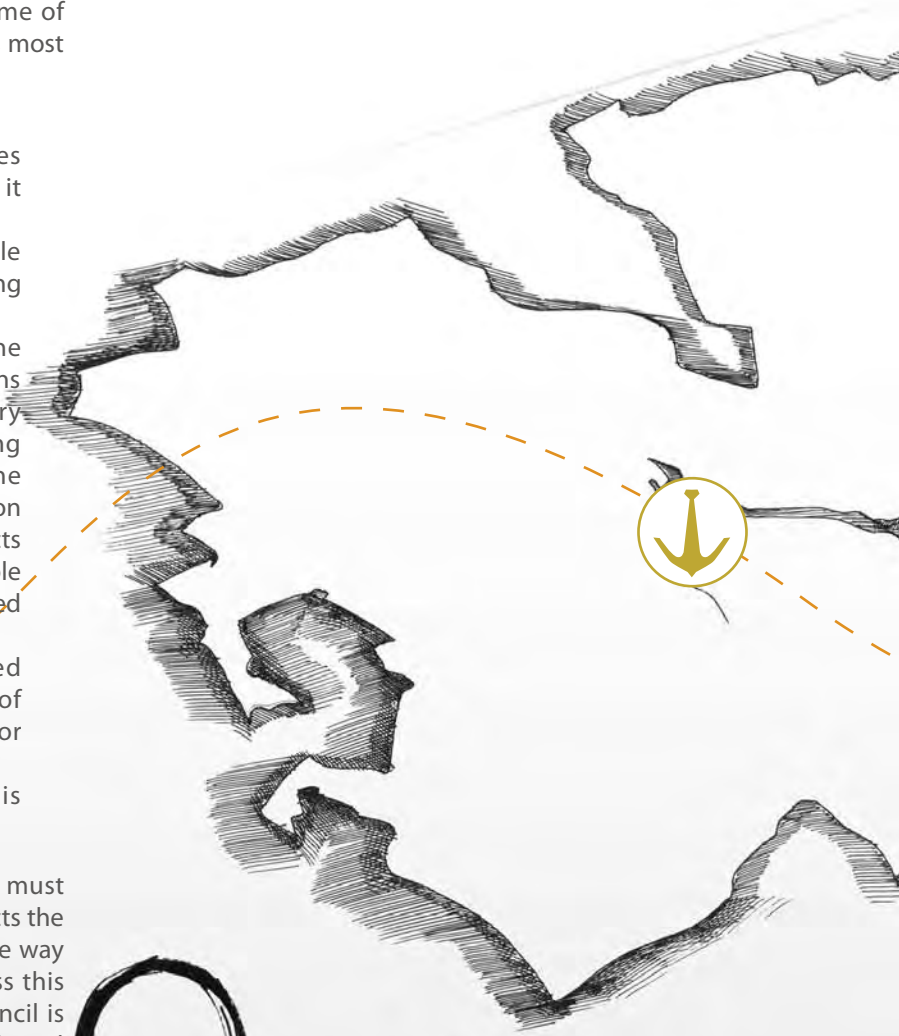
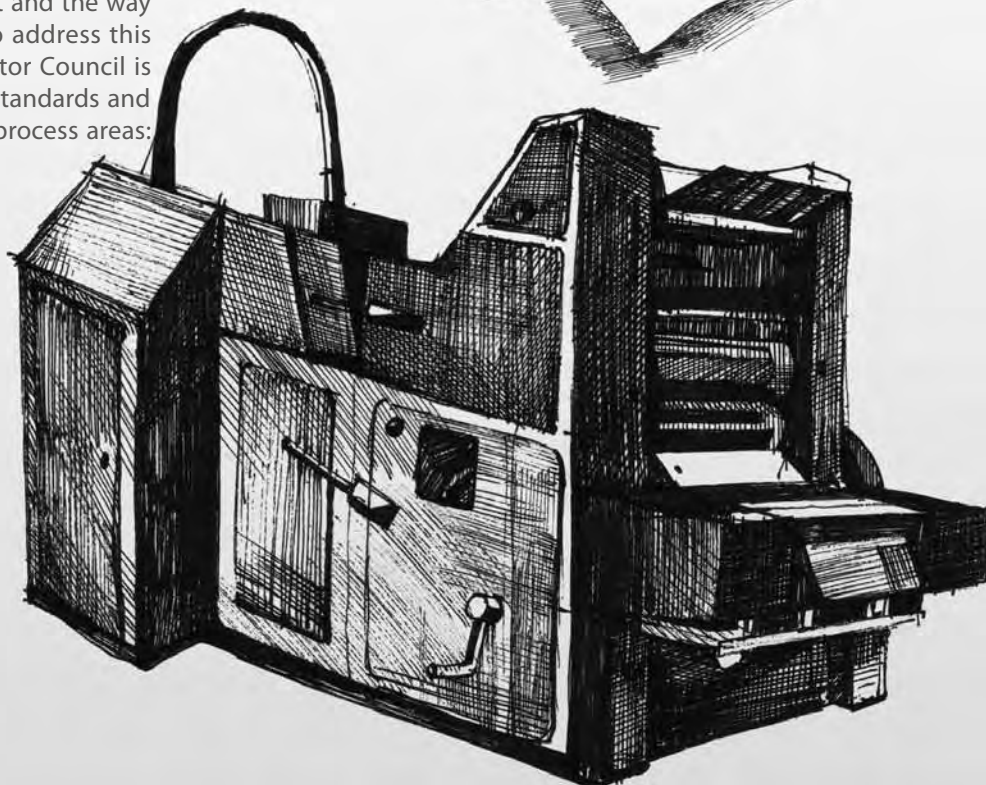
Skills shortages in two major areas

Within the printing and graphic communications industry, skills shortages are evident in two major areas: operating complex new print machinery, and understanding and leveraging the benefits spurred by the use of information technologies. A 2007 report prepared by the Canadian

Printing Industries Sector Council highlighted some of the printing and graphic communications industry's most glaring challenges related to training:

- Although some 41 percent of new employees have no formal training, most companies find it difficult to release employees for training.
- Although industry suppliers offer a considerable amount of training, little of it is distance learning or technology-assisted learning.
- A wide and persistent gap exists between the skills learned by workers at training institutions and the actual skills required to meet industry needs. For instance, educational programming meets the needs of only one element of the printing process: pre-press. Little or no attention is given to the press and finishing/bindery aspects of the industry, which leads many businesspeople to think that program graduates are not prepared for jobs in the industry.
- Many educational institutions discontinued programs or parts of programs due to lack of interest, and few institutions offer part-time or continuing education programs.
- More than 90 percent of in-house training is employee-to-employee training.

But for these issues to be addressed, the industry must first define a set of national skill standards that reflects the impact of technology on skills development and the way in which the industry is now organized. To address this need, the Canadian Printing Industries Sector Council is developing basic, core and functional skill standards and occupational profiles for all three printing process areas: pre-press, press and finishing/bindery.





III. WHERE IS OUR INDUSTRY GOING?

Although *Charting Our Course* is a valuable guide for all players in the printing and graphic communications industry, this section of the skills and technology roadmap is perhaps the most consequential. In it, the roadmap moves away from the current state of the industry and examines the specific trends in technology that will have the greatest impact on the industry over the next ten years. The section also links these technology trends to skills development, and in doing so, identifies some of the training challenges associated with the advanced technologies that will become increasingly apparent throughout the industry.

But before these technological trends are identified, two qualifications must first be raised: while core printing technologies continue to evolve, the impact of new technologies on industry businesses can vary from business to business due to the differences involved in implementing these new technologies. At the same time, technologies traditionally thought of as non-printing, such as the Internet, are clearly evident throughout the industry today, and are having a profound influence on industry businesses regardless their size or regional location in the country.

Seven Technology Trends Shaping The Industry's Future

So what are the trends in technology that will have the greatest impact on the development of the printing and graphic communications industry and the professional skills associated with the industry? There are seven:

1. Enhanced systems integration
2. Greater demand for database management services
3. Widespread use of customer interface software
4. Significant developments in press technologies
5. Increased automation and integration of postpress tasks
6. Radical new advances in science and technology
7. Ever-increasing environmental awareness

1. Enhanced Systems Integration

In the printing and graphic communications industry, advances in technology are having their greatest impact in the area of process. While some innovations apply directly to printing equipment such as presses, the real value of sophisticated new technologies lies in their ability to tie together, or integrate, various components or systems—giving printers much greater insight into what is happening throughout the printing process. Indeed, systems integration enables industry businesses to make incredible advances in the way they manage print-related processes, in the information these systems generate, and in the actions these systems foster.

Two main types of integration

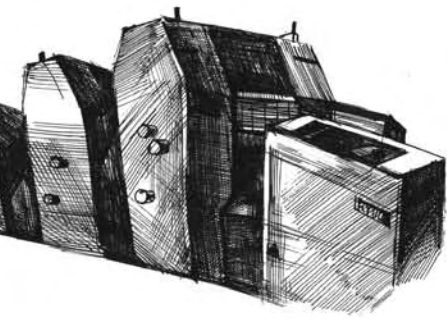
Systems integration can be divided into two major types: technical integration and business-level integration. Technical integration enables one machine to communicate with other machines, and is largely the purview of equipment manufacturers. Meanwhile, business-level integration involves taking several system components—from prepress all the way through to client billing—and linking them together to create larger systems.

Through integrated systems, such as management information systems, printers can generate operational efficiencies—better resource management, more accurate costing and improved administration—which can enable these businesses to increase their productivity. Integrated systems can also provide businesses with the information they need to develop and offer new products and services.

For instance, companies can use new technologies to seize new possibilities related to variable data printing by marrying direct mail with database management. But printers beware: providers of new technologies could also easily integrate printing into their own value chains to offer 'one-stop shopping' to customers—much like many packaging companies have done with the print component of their businesses.

Eliminating islands of automation

Systems integration also poses other challenges for printers. For example, manufacturers focus on developing individual pieces of equipment, which creates 'islands



automation' that need to be connected through specialized software. No central hub exists that is capable of correctly interpreting, storing and reporting on the various states and stages of a printing product as it evolves through the process.

Integration of various components also remains a highly customized process. And although Job Definition Format is a key platform for systems integration, a formal organization of industry users is needed to ensure that this new type of information carrier evolves in a way that transforms into plug and play.

These challenges are compounded by the fact that the underlying technologies of many systems are proprietary and cannot be altered to suit specific industry needs. For instance, many tools have billing capabilities, but these tools cannot interface with generic management information software. This kind of problem extends to customer relationship management software as well. To overcome this hurdle, manufacturers must open up their software to facilitate interoperability with existing client systems and with systems produced by rival manufacturers.

Advances driving greater integration

Three advances in software, however, are helping drive greater systems integration in the printing and graphic communications industry:

- Service-oriented architecture enables printers to avoid having to build new systems from scratch by integrating stand-alone operations into larger systems.
- Open source is a particularly powerful tool that industry players can use to solve software challenges commonly found in the industry.
- Software-as-a-service is a marketing and distribution model through which a software vendor develops and then hosts and operates an application via the Internet. Customers then pay for use of the software but do not own it.

But opportunities such as these can also bring threats. New software is playing a powerful role in reshaping traditional print value chains. In particular, software will enable printing to be combined with other services over the web. Known as a mash-up, this process enables savvy users to create composite applications that will make it possible for virtually anyone to combine software services

over the web. A simple example of this new printing phenomenon is Public Domain Reprints, a non-profit service that enables anyone with access to the Internet to take public domain books from sites such as Google Books and print them through services such as Lulu.com.

2. Greater Demand For Database Management Services

In the years to come, traditional customers of printing and graphic communications companies will want to increase their use of direct mail to include mailings not only targeted by name but also by income and other variables. Driven by advances in data mining, many other kinds of print products will also be customized according to the particular characteristics of target audiences.

Creating these types of products requires a combination of skilful graphic arts capabilities and expert knowledge of database management software. Indeed, expert database management lies at the heart of variable data printing. But while database management provides printers with a way to produce value-added services and strengthen relationships with customers, most companies are reluctant to seize this opportunity.

Their hesitation stems from problems related to data integrity. To properly complete jobs based on variable data printing, printers are required to vet and manipulate data. But solutions to ensure data quality are largely manual, making the process cumbersome, labour intensive and expensive. Some printers also lack a working knowledge of Canada Post regulations and mailing methods, which makes it difficult for them to price jobs accurately.

3. Widespread Use Of Customer Interface Software

One trend in technology that has profoundly changed operations in the printing and graphic communications industry is electronic file delivery. Using software such as Adobe Acrobat®, organizations have for years been able to send their printing jobs to any printing company or an in-house printing service with the click of a button.

In fact, once the content of a printing job is in digital form, it can be transferred quickly and seamlessly from



creator to reproducer to consumer. Known as repurposing, this practice eliminates from the printing process those printing companies that do not provide cross-media or other value-added services to customers.

Web-to-print (Internet): the next phase of re-purposing

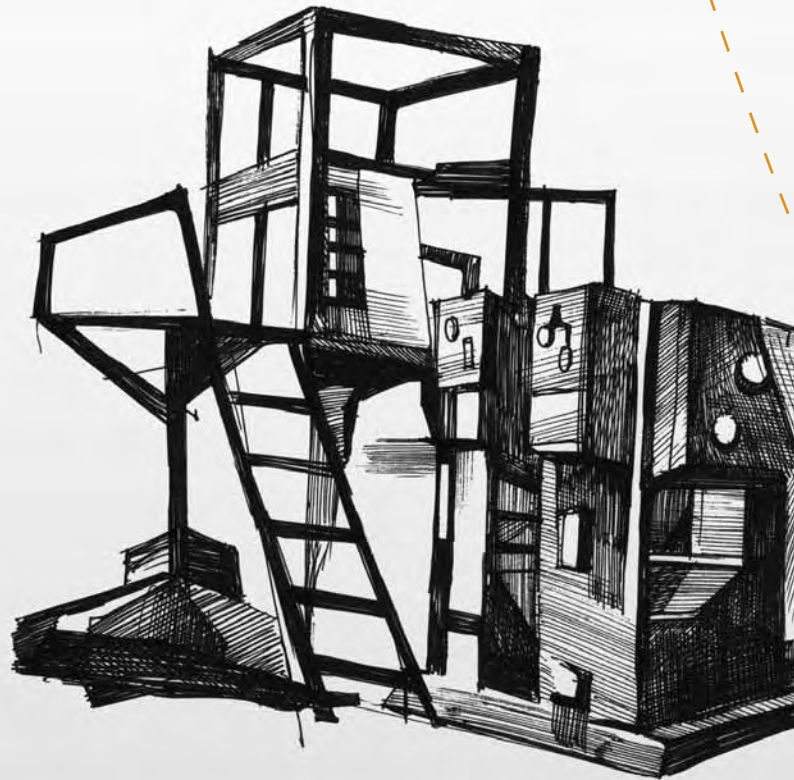
In the years to come, repurposing will continue to evolve. The next phase of this practice is web-to-print. The most advanced subset of the Job Definition Format software suite, web-to-print makes printing fast and simple, and enables organizations to forego setting up their own in-house printing capacity.

Also known as remote publishing, web-to-print takes advantage of breakthroughs in customer interface software to bridge the gap between online digital content and commercial print production. Indeed, web-to-print systems are wonderfully simple. Each system comprises a server, which acts as the central point for communications, and a web browser, through which users interact with the server. The main components of these servers are databases, which act as central storehouses of large amounts of structured information.

Although web-to-print is beginning to flourish, printers are questioning how to use this technological advance to create new business models. Two obstacles are immediately identifiable: while the United States has two print buyers that provide independent advice to potential web-to-print customers, Canada has none. And the graphic arts element of the industry needs to become more science-based to help printers meet the increasingly sophisticated needs of their clients.

Improving customer-relations skills is vital

Printers will also need to focus sharply on improving customer relations as web-to-print becomes entrenched in the printing and graphic communications industry. With web-to-print, printers will begin to interact with their clients in entirely new ways and will have greater opportunities to develop even stronger business relationships with customers. For printers to prosper, they will have to embrace this reality and appreciate that their businesses are now more service providers than manufacturers. According to one prominent industry observer, however, this new truth is still a barely dawning realization for many industry vendors.





4. Significant Developments In Press Technologies

More than 70 percent of the companies in the Canadian printing and graphic communications industry are small businesses. As such, these companies may not be able to spend significant amounts of money on printing equipment in the next ten years. They are more likely to try to extend the lives of existing equipment through affordable add-ons. In many cases, these add-ons will take the form of software that companies can use to integrate various items of existing equipment, add overall process control and communicate more efficiently with customers.

Despite this trend, press technologies lie at the heart of the printing industry, and as such, they are always advancing. The most noteworthy developments in press technologies are being made in the following areas:

More effective colour workflows: On-screen colour management, also known as soft proofing, is on the horizon, and will provide printers with more effective colour workflows with which to compete with electronic media.

Easier digital printing: Digital printing is a plate-less process through which an image is created directly from a computer file without any intermediary steps. Because every impression is taken from a freshly created image, digital printing is the process of choice for variable data printing and short runs for small or highly segmented markets. Digital also requires no make-ready and enables printers to perform virtually instantaneous production changeovers.

Despite these advantages, the industry penetration of digital printing is only five percent. Cost is one reason. Another is speed. Although digital printing speeds have increased dramatically, offset speeds are still faster than the best inkjet digital printer.

Faster digital printers: One notable advance uses a print head that spans the width of the paper it prints on, increasing printing speed by eliminating the time it takes for the print head to shuffle across the paper.

Improved workflow: From digital files to finished products,

the production process will become increasingly integrated as non-proprietary software such as Job Definition Format seamlessly route both printing content and instructions through the production process.

Greater technology integration: Although established printing processes include highly refined technologies that have evolved continually over time, hybrid printing will grow to capture the best qualities of different combinations, such as offset and inkjet, flexography and gravure, offset and toner, flexography and toner, and flexography and inkjet. What is more, hybrid press technology will grow and the use of digital technologies will expand quickly over the next three to five years. Offset printers will acquire new systems that include the capabilities found in digital printers. And existing technologies will become more widespread as they standardize and become more integrated within the overall printing infrastructure.

Inexpensive three-dimensional printers: Although large corporations pay \$100,000 for these rapid prototyping machines, desktop versions are now available for \$5,000.

Increasing demand for large-format printing: Printing of documents the size of posters and even larger will become more common.

Significant advances are also being made in inks, papers and coatings:

- Nano-particle inks produces images as good as those from the best rotary gravure presses used to print coffee table books.
- Water-based inks reduce emissions from volatile organic compounds.
- With no solvent to evaporate, ultra violet-curable inks cure rapidly, permitting high-speed printing of multiple colours.
- Security applications are taking advantage of specialty papers and thermal technology.
- Inkjet and laser papers are being developed to fulfil special requirements, while paper is being specifically designed for digital presses, and printers are increasingly calling for papers that can be used by digital and offset printers.
- Talc, whose combination of properties and chemical inertness make it unique among all

minerals, is being used to improve profitability in several niche coating applications such as rotogravure, matte offset, barrier coatings and labels.

- Nanotechnology produces ultra-thin surface coatings and barriers for specialty papers.

5. Increased Automation And Integration Of Post-Press Tasks

Innovations in post-press equipment promise to automate many labour-intensive tasks and, as a consequence, boost overall productivity for printing companies. Advances in robotics and information technology should have the most impact on post-press.

Through robotics, printing companies will be able to automate many of the tasks now performed by workers. Meanwhile, information technology such as Job Description Format will link the work being done by robotic devices into larger processes and functions. For instance, linking the operation of cutters and other tools into the overall printing process will enable companies to improve scheduling and resource management.

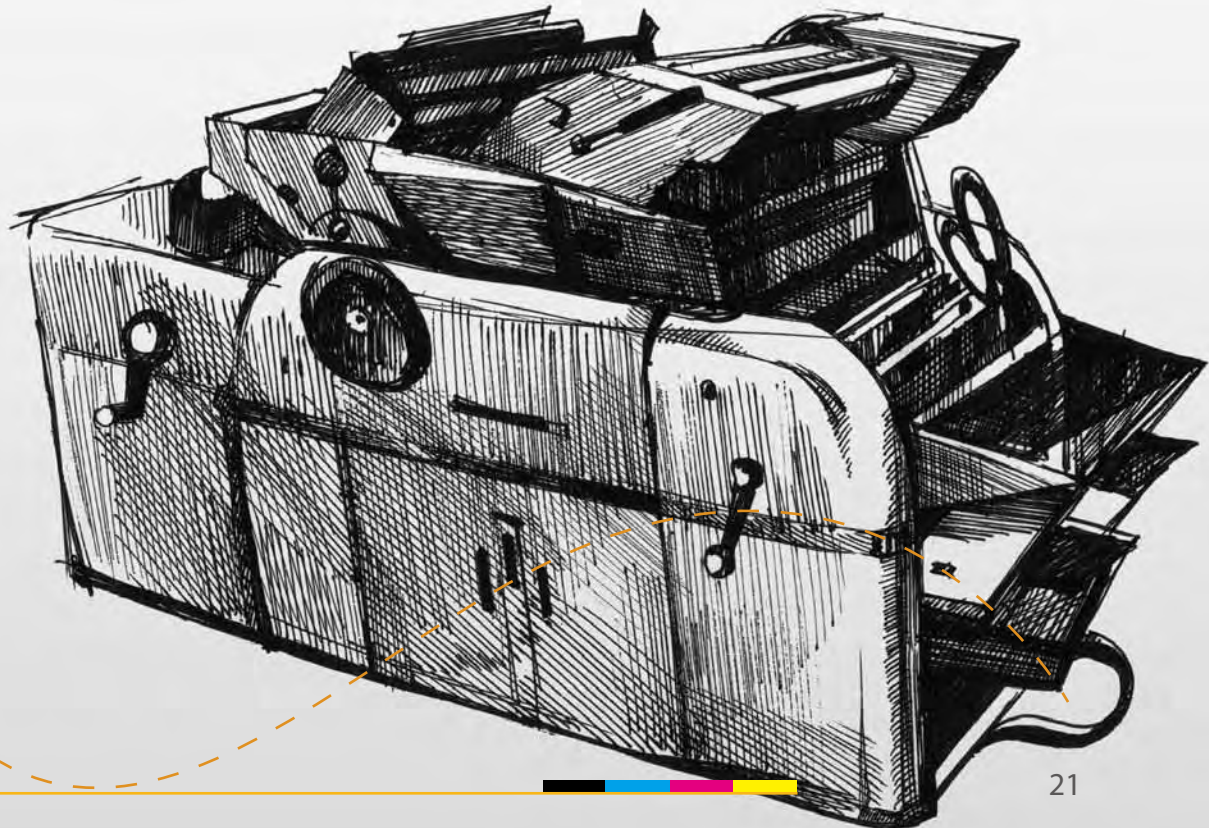
In the areas of distribution and fulfilment, these two technologies will also play greater roles. Robotics will

enable printers to automate the largely manual tasks associated with handling and shipping materials, while information technology will make it possible for printers to integrate handling and shipping into the overall printing process—again, improving scheduling and resource management. As a matter of fact, advances in information technology promise to present a number of new opportunities in fulfilment, as there are many services that can be added to basic print offerings to develop complete offerings that address the needs of specific vertical markets.

Despite this promise, industry players are reluctant to embrace Job Definition Format for post-press tasks because of the added cost of purchasing new capital equipment. Post-press equipment with the needed data-link capability exists, but printers most likely will keep current systems in place to amortize costs over the typical ten-year lifespan of the equipment.

6. Radical New Advances In Science And Technology

Five radical new advances in science and technology should present opportunities for the printing and graphic communications industry:



- Secure packages will contain nanoparticles that change colour if the packages have been tampered with or if the shelf life of the packages has been exceeded.
- Printing will be done directly on food; for example, advertising messages on potato chips.
- Special pill coatings will allow for sophisticated printing on pharmaceutical products.
- Putting ink in paper will do away with ink cartridges and enable printers to become smaller and lighter, possibly opening the door to incorporating printers into hand-held devices such as digital cameras.
- Radio frequency identification tags, which use energy received from an incoming radio signal to broadcast data, will be used by retailers to track inventory, sales and product movement. Although current tags are made up of a microchip and antenna, printing the tags' circuitry directly on products or paper labels could produce less expensive tags.

7. Ever-Increasing Environmental Awareness

In the printing and graphic communications industry, many technological advances will be made along environmental lines. These advances can be grouped into two categories: advances that affect inputs and those that affect processes.

The list of inputs that will be affected by technological advances is short. Organic solvents will be removed from inks and other support chemicals, while recycled paper will continue to be a subject of improvement efforts. On the other hand, many environmental concerns can be—and will be—addressed by new processes—from recycling fountain solutions to implementing major programs such as the Sustainable Green Printer Partnership. Printers will bridge the gap between inputs and processes by increasing use of energy-efficient equipment such as high-efficiency motors and driers.

A key driver of this change will be ever-increasing public and industry awareness of environmental issues. Neglect of these issues by the industry can be viewed as a threat to industry health. Indeed, the prospect of major disruption in the industry is real, driven by the possibility that strict environmental regulations will bar the use of certain printing compounds and processes.

Increasing profitability while ensuring environmental sustainability

Fortunately, many businesses have shown that it is possible to be both environmentally sustainable and profitable. But it takes work:

- Printers will have to educate customers on the industry's efforts to become more environmentally responsible via environmental certification.
- Environmental actions by the industry must be extended beyond printing itself to include ways that reduce energy costs and demonstrate good corporate citizenship, such as power generation via solar panels.
- Environmental certification procedures will need to be expanded to include the printing and graphic communications industry.

Some customers are already demanding that their print suppliers be green-certified. However, most certification options are not readily applicable to the printing and graphic communications industry. Printers are also discovering that certain options previously considered environmentally friendly are decidedly less so once all the ramifications are considered.

For instance, the use of recycled paper often requires the use of volatile organic compound-based inks, slower press speeds and higher wash rates. The impact of transporting and processing recycled paper can be greater than the manufacture of new paper. And certification often comes with a range of membership, audit and certification fees.

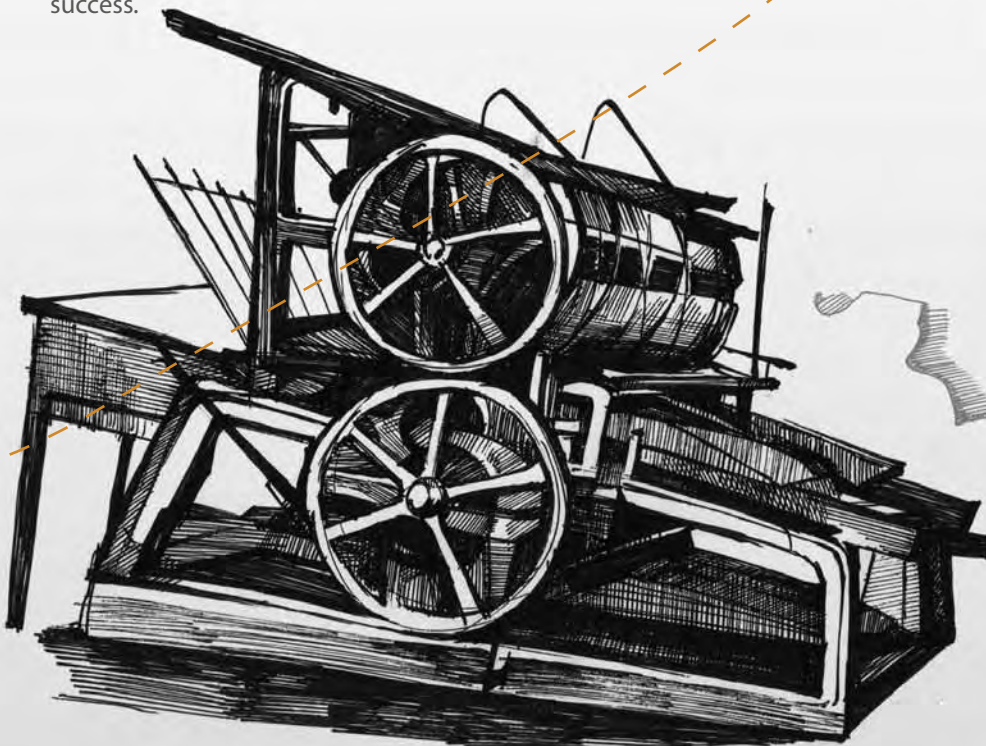


What's next?

These seven trends in technology are forecast to have the greatest impact on the development of the printing and graphic communications industry and, by extension, on the professional skills associated with the industry. Indeed, as pointed out earlier in this skills and technology roadmap, the adoption of new technologies is radically changing the industry's workforce. And while the technologically advanced industry of the future may require fewer workers, these workers must be highly skilled, with broad knowledge of printing processes and specific skills in particular areas.

Workers must also have access to the training needed to manage new products and services, and deal with the implementation of new systems and processes brought about by advances in technology. In effect, the ability to attract skilled new workers, train existing workers to manage new technologies, and perform that training in a cost-effective manner has quickly become a major challenge for the printing and graphic communications industry.

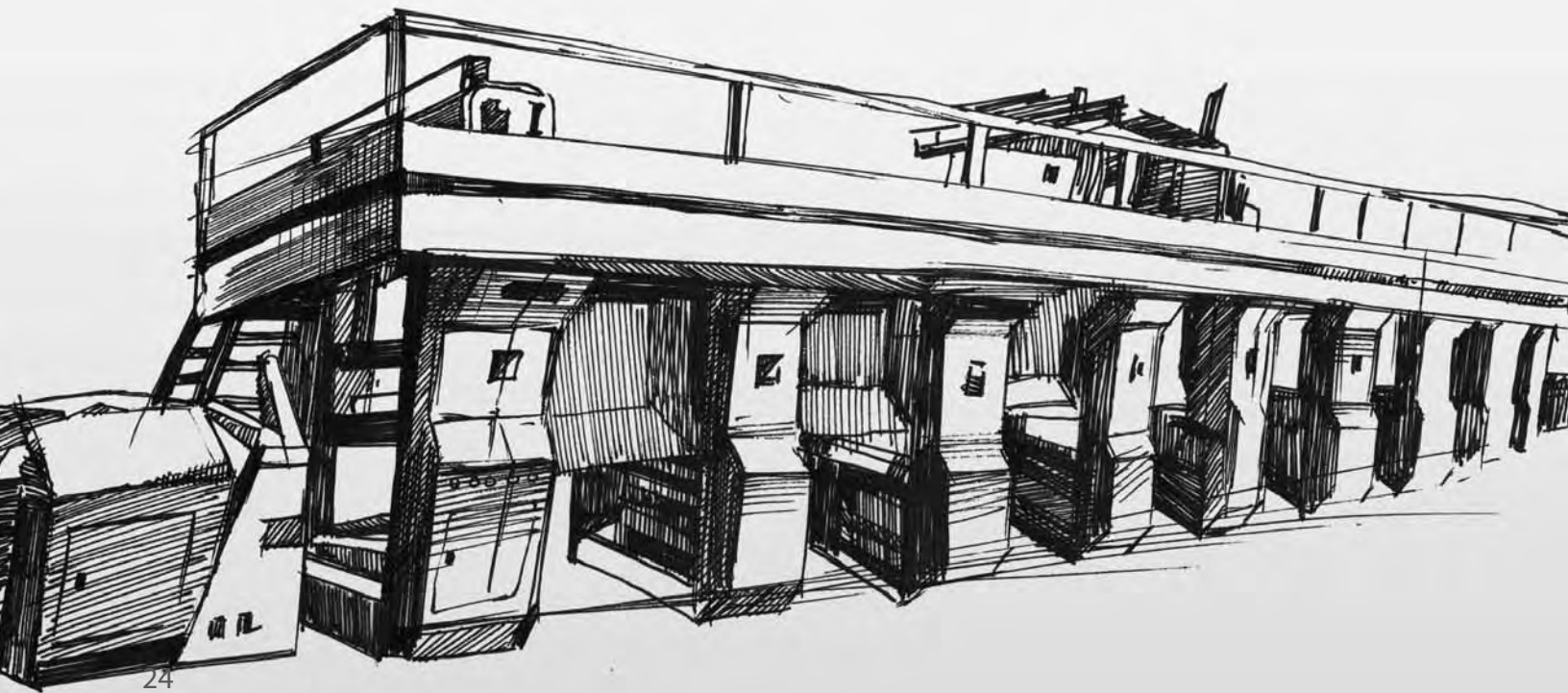
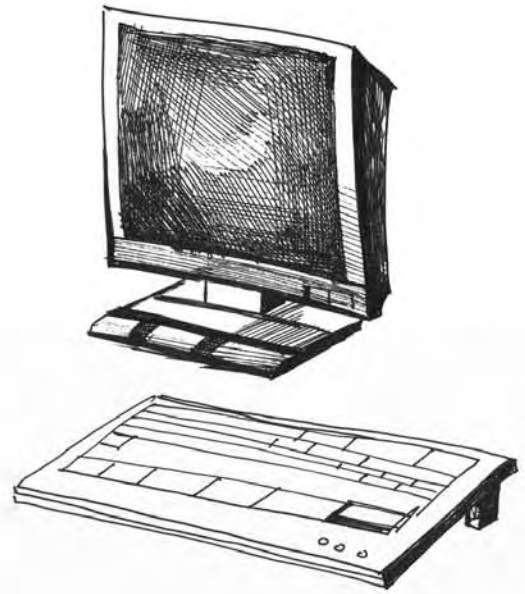
Accordingly, the next section of Charting Our Course provides vital recommendations to ensure the printing and graphic communications industry can address and overcome this fundamental challenge to growth and success.



IV. HOW DO WE GET THERE?

In surveying Canada's printing and graphic communications industry, it is all too easy to become overwhelmed by the pace of technological change and the skills development and training challenges that this transformation presents. This section of the skills and technology roadmap, however, gives industry players a series of sensible, straightforward recommendations to address these challenges.

The following strategic and tactical moves have been validated through several intensive meetings at which a wide cross-section of industry players modified draft recommendations and suggested new ones. Together, these seven recommendations will help industry players ensure current and new industry workers gain the skills they require to thrive and the industry to prosper.





SEVEN VITAL RECOMMENDATIONS

1. Explore development of national training programs and delivery models based on industry-developed skills standards

In the future, printing companies will require adaptable, multi-skilled workers who can operate computerized high-technology equipment, analyze problems, make decisions, work cooperatively, interact with customers and enjoy a clear understanding of the entire printing production process. But while many educational institutions offer industry-related courses, the industry must begin exploring a range of training programs and delivery models to ensure courses equip emerging industry workers with the skills they require.

For instance, training options should enable the industry to produce a highly skilled workforce—one in which workers possess not only a broad range of knowledge, but also expert skills in highly specialized areas. At the same time, training programs should be based on occupational profiles, workforce demographic, employee attrition and skills standards. And these skills standards should not only be used for training. They should also recognize current workers who satisfy competency standards defined by the industry.

Training itself should be flexible, geared to the needs of different workers and developed in partnership with current training providers such as suppliers and educational institutions. Training delivery should also reflect employee-to-employee knowledge transfer—such as on-the-job training, apprenticeships and mentorship models—as well as formal and non-formal training environments. Indeed, training should stress in-house programs, which minimize the time employees spend away from their jobs.

2. Develop management and process training tools

Owners and operators of small and medium-sized printing businesses must have easy access to tools that help them grow their businesses. Foremost among these new tools should be business seminars offered locally and led by champions of the new printing industry. These seminars would be ideal venues for industry owners and operators to:

- Accelerate adoption of proven technological advances,
- Improve understanding of the market realities of dealing with large and small clients,
- Share practical sales know-how,
- Explore ways to increase clients' involvement at the pre-press stage, and
- Discuss ways for industry businesses to make sound investments.

3. Create an industry-awareness program

The printing and graphic communications industry faces an alarming shortage of new talent to fill its ranks. Attracting young people to the industry and then providing them with education and training can overcome this shortage.

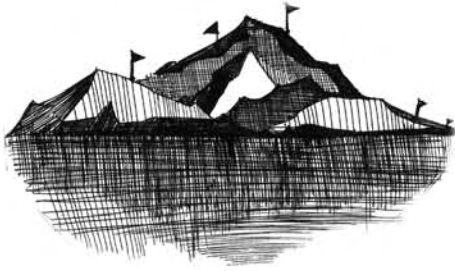
To attract new workers and retain current workers, the printing and graphics communications industry must create an industry-awareness program. This program would position the industry as an attractive career destination by clearly conveying the career opportunities available to prospective and current industry workers.

A career awareness advisory group made up of key industry players would be responsible for developing activities to generate positive industry awareness. For instance, the group could organize school visits by printers, organize visits by students to printing plants, and encourage schools and business to create co-operative education programs.

Awareness-building activities should also target clients. These activities would help clients not only understand the steps the industry is taking to implement technological advances, but also appreciate how these efforts are designed to improve client service.

4. Improve systems integration capability

Advances in information and communications technology are quickly reshaping best practices in printing. In particular, Job Definition Format is enabling the industry to automate specific tasks, and in the process, has helped the industry reduce costs. But since printing will feature increasing levels of automation across separate operations in pre-press, press and finishing and bindery, as well as across management information systems, industry



players should focus on improving systems integration as opposed to solely focusing on automating specific operations.

And while systems integration standards are now being addressed by an industry working group (CIP4), more work needs to be done—not just now, but on an ongoing basis. For instance, although appropriate standards may be in place within five years, many printing companies will continue to use old equipment and, therefore, a substantial portion of integration will be customized from company to company. As a result, industry workers will need to continually develop specialized skills and tools to perform successful systems integration—whatever the industry standards end up being.

5. Develop a database management research program

Printers must acquire the skills and resources to take advantage of opportunities brought about by advances in technology—opportunities such as variable data printing. As such, the industry should develop a comprehensive program—in conjunction with research institutions—that would generate tools to automate database verification.

6. Enhance industry access to support for training and technology

Printing companies largely acquire new technologies via purchases of capital equipment and the associated training that workers take to leverage the features of this equipment. As such, the industry should continue its lobbying efforts to enable printing businesses to obtain favourable tax treatment for the purchase of capital equipment and the provision of in-house training. The industry should also assist small and medium-sized enterprises to access scientific research and experimental development tax benefits, which would help these enterprises acquire vital technology know-how.

7. Support greater environmental awareness

As consumers become more environmentally aware, the industry must help printers become better educated on the economic benefits of in-house sustainability initiatives. At the same time, the industry must work with governments to shape a 'green measure' that applies to the printing value chain and provides printers with a broad perspective on environmental practice that they can call their own.

On a final note

As this skills and technology roadmap makes clear, rapid advances in technology have had a particularly sharp influence on the industry and are radically transforming the skills-development requirements of current and emerging industry workers. But industry players need not shrink from the challenges brought about by technological advance. Companies not only can survive in the industry's changing marketplace, but also prosper.

Some companies, however, have embraced the challenges highlighted in this skills and technology roadmap, and used them as a springboard to achieve even greater performance and profitability. Known as 10 percenters, these businesses do not just eke out a meagre one-percent profit after expenses. They achieve profits margins of at least ten percent.

What makes these enterprises different from other businesses in the industry? Three attributes of 10 percenters can be identified:

- **They focus on improving internal processes and reducing costs.** Ten percenters address their systems integration challenges and implement tools and processes that help them maximize efficiency and minimize costs. They can tell you exactly what each job will cost them, and they price—or reject—work accordingly.
- **They focus on their people.** Ten percenters attract and train employees by adapting their human resources practices to make their companies attractive to young workers.
- **They focus on strategically building their markets.** Ten percenters maximize the use of existing equipment or use their business strategies to target and rationalize the purchase of new equipment.

These companies have demonstrated how to thrive in an era of continual and transformational change. They have charted a course to success and have reached their destination. This skills and technology roadmap presents a clear and proven path for other companies in the printing and graphic communications industry to follow.





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Skills and Technology Roadmap (STRM)

Acknowledgements

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Steering Committee Members

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Dion, André; Institut des Communications Graphiques du Québec
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